Digesting Manure in Dry Climatic Conditions

Perspectives from beef operations digesting feedlot manure

Renewable Energy Education Field Day
Las Cruses, N. M.
October 26th, 2011

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HIGHLAND FEEDERS
PREMIUM ALBERTA BEEF

Renewable Energy Field Days

Highland Feeders Limited (HFL)

Feedlot Background

- Founded 1983 – Last expansion occurred in 2001
  - Standing Capacity – 36,000 Hd. (finish 50,000 to 70,000 annually)
  - Open Pen, clay – sand pen base
- Climate – Semi Arid
  - Annual precipitation – 17 in. (rain and snow combined)
  - Temperatures – highs 95 to 100 degrees, lows 40 degrees below 0
- Cattle types – All beef breeds
  - Cattle placed on feed as light as 350 lbs and as heavy as 1000 lbs
  - All cattle are feed to slaughter weighing as heavy as 1500 lbs

Aerial View of HFL

Anaerobic Digestion at HFL

Project Background

- In1995 HFL began investigating alternatives for processing manure
  - The initial driver was environmental regulations
  - Outcome process parameters were set including the following ; must lower manure handling costs, must conserve water – nutrients - organic matter, must reduce or eliminate pathogens, must be net energy positive.
- Anaerobic Digestion process was selected
  - In 2000 a world wide technology search concluded that no existing technology was suitable for dry, high solids manure produced at the volumes and conditions in North American style feedlots.
  - In 2001 R&D work began to develop specific technology to overcome these challenges
  - In February 2005 the only Thermophilic AD plant of its kind was up and running at HFL.

IMUS is Born

Integrated Manure Utilization System (2005)

- Processes ~110 tons of high-solids feedlot manure and other waste daily
- Produces up to 1MW of continuous electrical output, biofertilizers, heat and reusable water.

IMUS Today

Integrated bioMass Utilization System (2011)

- Currently Processing ~ 275 tons of manure and other bioMass (slaughter house waste, SSO – source separated organics)
- Produces up to 2.5 MW of continuous electrical output, biofertilizers, heat and reusable water.

IMUS Today

Integrated bioMass Utilization System (2011)

- With the second 2 million ga. digester completed the plant will consume 550 tons of manure and other bioMass
- the AD plant will produce a total of 10MW thermal and 2.5 MW electrical energy required for a 10 mgpy ethanol plant currently under construction.

Feedlot Manure

Feedlot manure can be highly variable in quality

- Muddy Pens yield poor manure quality –volatile solids low as 30%
- Routinely harvested pens yield manure with volatile solids of 75%.

Beneficial for the feedlot operation because of improved cattle performance and reduced feedlot maintenance.

How do you feed that much high solids manure?

- The 80 ton capacity bulk feeder handles very dry or wet material.
- The feeding system feeds the digesters around the clock separating out oversized objects - large rocks or pieces of concrete.

What happens to the sand – dirt- small rocks??

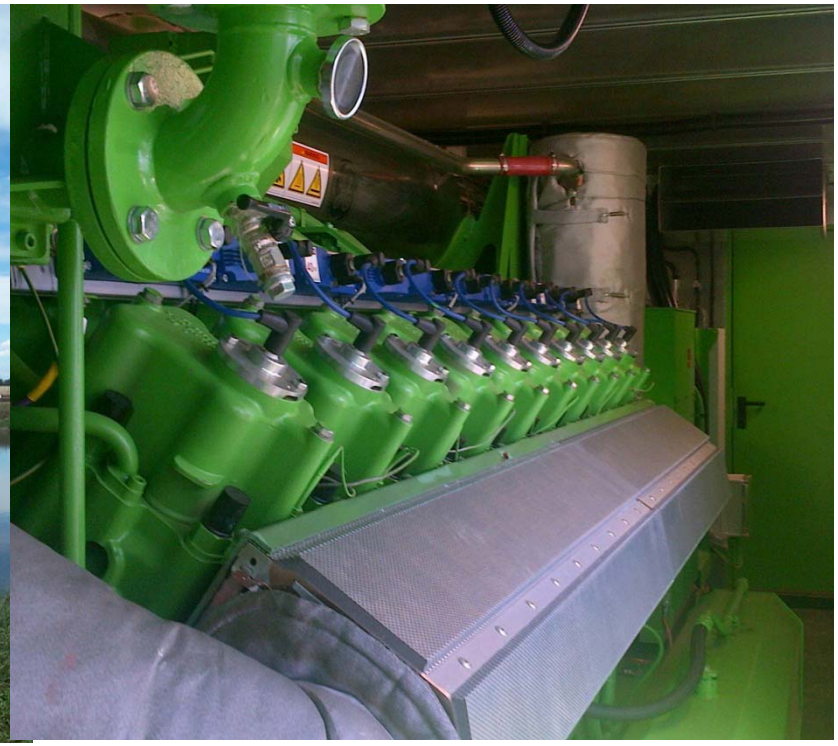
- We used to try separate it out in the front end. A dismal failure!
- Highmark Renewables was able to develop a Patented continuous digester cleaning system called **Clean Slate ™**
- Sand and Grit is re-used for pen maintenance or could be re-used for bedding in dairy operations

Can yield be proven with such variable manure?

- Our technology provider had this mobile test unit deployed in Kansas for 4 months doing manure to methane yield determination.
- They have another unit operating in the desert climate of Pakastan

What are the outputs?





- Pathogen free

Nutrient rich bio-fertilizer

- Irrigation water
- Electricity and Heat

Challenges? Yes

Nothing 10 years of teeth grinding and butt clinching won't overcome !

- **Capital cost to high for livestock operations to absorb on their own**
  - **-Requires partnerships with strategic equity and debt sources or third party Build Own Operate model**

- **New types of relationships required**
  - **-Long term supply and off-take agreements**
  - **-Agriculture and Energy partners need a better understanding of each others business**

- **Its not as easy as we might think and hope**
  - **-Don't lose focus on your core business**
  - **-Find experienced partners and technology providers to work with**
  - **-Know your operations inputs and outputs well**
  - **-Performance guarantees will save your back-side but they aren't easy to get**

Thank You All Very Much

Come see us at Highland in Person or visit our Website